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**CURRICULUM STUDY
OF PUBLIC WORKS
MANAGEMENT**

BY

**JOHN M. ELLWOOD
LT, CEC, USN**

**A REPORT PRESENTED TO THE GRADUATE
COMMITTEE OF THE DEPARTMENT OF CIVIL
ENGINEERING IN PARTIAL FULFILLMENT OF
THE REQUIREMENTS FOR THE DEGREE OF
MASTER OF ENGINEERING**

**UNIVERSITY OF FLORIDA
17 JUNE 1999**

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Dedication:

This report is dedicated to the United States Navy, which I owe for my education, to my parents who taught me to value education, and to the Lord, my God, the creator of all things.

Abstract

This study reports on a curriculum, based on input from the U.S. Navy and the American Public Works Association, for a Public Works Management Program. The report proposes a standard curriculum that can be universally recognized and designed to enhance the profession of Public Works Management.

Beginning Quote :

Two Hundred graduate-trained public works managers is not nearly enough.

New management challenges are creating demands for broader management skills.

Because engineers lack management skills, there is a trend toward fragmentation of public works functions, toward diminished status of public works, and toward placement of non-technical managers in public works positions.

The public works profession has not exercised sufficient innovative leadership to search for new approaches and new technologies.

Speech on behalf of the Public Works Alumni Association made to the American Public Works Association Board of Directors in 1987:

- Dennis Polhill

Acknowledgements:

Successful completion of this master's report would not have been possible without the guidance, direction, and enthusiasm of my graduate committee chairman, Dr. Fazil Najafi. I must also mention and give special thanks for the input and guidance received from Dr. Dennis H. Ross, of the American Public Works Association. Finally, I would also like to thank my Navy classmates and colleagues, who have provided support and input for this report.

Definitions

Core Courses - Courses considered to be the heart of a program of study and required for completion of specialization.

ESRs - Education Skill Requirements developed by the U.S. Navy to ensure graduate students meet certain requirements for a subspecialty code.

Discipline - a field of study that perfects the mental faculties towards a specialization such as public works management.

Infrastructure - Public physical systems which support civilization, such as potable water acquisition and distribution, waste water collection and treatment, solid waste collection and disposal, transportation systems, parks and facilities, and other common distribution of utilities for the benefit of community.

Manager - A person who provides leadership and direction to a team and has judicious use of a means to accomplish an end.

Program of Study - A specialization or area of concentration within a graduate level degree. Generally, areas of specialization for civil engineering include construction management, geotechnical engineering, hydraulics, civil engineering management, structural engineering, and public works engineering.

The foundation of civilization is supported by its infrastructure. Civilization is defined by Webster's Ninth Collegiate dictionary (copyright 1985) as a relatively high level of cultural and technological development; or a situation of urban comfort. Therefore to create this level of urban "comfort", a foundation of infrastructure is required. The design, construction, maintenance, operation, and management of physical systems for transportation, utilities, water resources, solid wastes, and other public facilities, deemed as infrastructure, are essential to the sustainability of civilization. Moreover, the social and economic capability of a community is proportional to the extent and quality of its infrastructure. Thus, the quality of civilization depends on infrastructure and its management for our health, safety, and continued growth.

The more advanced a civilization is, or is to become, the more advanced the infrastructure will be. As infrastructure advances and expands, the management of these systems becomes increasingly complex. Besides the advancing technology of physical systems, organizations responsible for the infrastructure have become more complicated. It is essential that those in key positions

of responsibilities are prepared to resolve problems of a complex nature. Therefore society must assure that managers of these systems are professionally trained to influence and manage the infrastructure that civilization is based upon.

As the foundation of civilization is supported by its infrastructure, the foundation of a profession is supported by education. Education and experience are combined to produce competency. Generally experience will vary from one successful manager to the next, but the education a professional engineer will receive is usually similar. Therefore it is imperative for a society interested in advancing civilization to maintain standards of education for its professionals responsible for its infrastructure.

The goal of this paper is to propose a standard of core courses for a graduate curriculum benefiting Public Works professionals seeking to be responsible for the development, operation, and maintenance of urban infrastructure. Although this paper is primarily intended for professionals directly responsible for the shore establishments of the United States Navy, similarities and differences of the needs of civilian communities will be addressed. For the most part the proposed graduate curriculum is based on a survey of senior Naval Officers serving in the Civil Engineer Corps of the U.S. Navy and contrasting views based on a survey of senior Public Works professionals that are members of the American Public Works Association.

Chapter TWO - - - Background and Perspective

Most universities offer traditional disciplines and offer traditional degrees for those who meet traditional requirements. However, some professions, especially public works management, need grounding in several disciplines, such as Business, Planning, Finance, and of course Engineering. Generally universities are hesitant to combine disciplines into a single professional field because faculty resent academic heterogeneity and that professional colleges are established with a sense of student demand, as well as financial contributions for research for a particular field.[1] Therefore academic programs leading to a degree in public works management (PWM) are few and far between.

Of the universities that do offer programs of study for PWM many experience frustration of keeping the program sustainable. The American Public Works Association (APWA) officially recognizes institutions that offer Public Works programs and tracks program activity to a certain extent. Discussions with Mr. Dennis Ross, of the APWA, lead me to believe many of the universities experience difficulty in keeping the programs active for mainly two reasons, lack of students and lack of professional advisors.

Why this lack of interest exists in such an important field is not determined, only that it is a contributing factor to the dormancy of PWM programs. Military students returning to school for a Master's Degree, as part of a career requirement, augment some of the PWM programs. Normally a naval officer in the Civil Engineer Corps between the 5 - 10 year point in their career will be selected for graduate school. Over the last 4 years only a small percentage of Civil Engineer Corps (CEC) officers selected PWM as their program of study, even though the majority of positions available fall into the realm of Public Works. (A recent study of the Civil Engineer Corps indicates 203 PWM positions compared to 64 Construction Contracting positions among senior officers (0-4 and above)).[2] This lack of interest by navy military professionals could possibly be attributed to the lack of good academic programs available. The following chart, table 1, displays the primary programs pursued by navy CEC officers over the last 4 years.[3]

TABLE 1

<u>CURRICULUM</u>	<u>FY-95</u>	<u>FY-96</u>	<u>FY-97</u>	<u>FY-98</u>
Construction Management	25	25	22	22
Environmental	14	8	13	8
Ocean Engineering	4	4	4	3
Financial Management	3	2	1	1
Public Works Management	3	2	1	6

Keeping a PWM program active also requires an advisor that is interested in the program and believes in its merit. Professional advisors are professors who devote time to students and the program for which they are responsible. The lack of professors interested in Public Works seems to be a problem. Often a program will become defunct once a professor retires or moves to another position. According to Mr. Dennis Ross, the University of Pittsburgh had one of the most successful PWM programs until the retirement of Dr. Joel Abrams.[4] Since then the program has been eliminated. Cleveland State University has since had the most active program but the professor responsible for the program has relocated and the program there has also fell into a dormant state.

Location of the university could also be another reason why professionals, who may want to further their education but do not because they cannot or are not willing to relocate. With the advance of technology of communications becoming more common, distance may not pose a problem in the near future as it has in the past.

It seems to make sense, that if you build it, they will come. However many Universities have had little success with a Public Works program.[5] None seem to have proved to be commercially successful. Texas A&M and University of Florida currently have a few military student which help keep their programs active. The California State University -Long Beach program is currently dormant. The Public Works program at Golden State University is no

longer offered. The University of Missouri - Kansas City is currently active but has no students. And of the 11 universities that are recognized by the APWA, only the following five have some sort of success of keeping these programs active; University of Florida, Illinois Institute of Technology, North Carolina State University, Northeastern University, and Texas A&M University.[6] Although there are other institutions in the United States that offer graduate programs in Public Works management or administration they have not been reviewed or have not requested official recognition from the APWA. (APWA policy of providing recognition has since ceased.)

As cities continue to grow and infrastructure is expanded and technology evolves, managing Public Works becomes increasingly complex, especially with an increased awareness of the environmental concerns. If education is the foundation of a profession then advanced/innovative continuing education must be a requirement to assist tomorrow's leaders of Public Works organizations. Graduate programs should focus on providing the foundation of our future leaders.

Chapter THREE - - - Graduate Public Works Programs

It is rather obvious that the more prepared one is, the greater are the chances of success. [Chance favors only the mind that is prepared. - Louis Pastuer] A Public Works Program should prepare the graduate student to be highly effective in the future of Public Works organizations. A good program would attract engineers who desire to enhance their development. (This is especially true in the Civil Engineer Corps of the U.S. Navy where it is required to obtain a Masters Degree to continue their career.)

In the United States, PWM education was initially developed in 1929 at the School of Public Administration at the University of Southern California. The primary directive was to provide graduate education for city managers. This program was lead by Dean Emery Olson and viewed PW managers as a market opportunity to improve the practice of public works.[7] Other programs have come and gone since then. And today, 70 years since its implementation, there still lacks a consistent curriculum of this important field.

Different universities offer PWM programs usually consisting of different required core courses to accomplish the same goal of advancing the skills required by the profession. All of the PWM programs researched are more different than they are similar. Some programs are more flexible than others to attract a wider variety of

students. However they all have standards maintained by a required curriculum. Examples for some of the PWM programs follow:[8]

Cleveland State University
(MPA with PW track)

- ❖ The Political Process
- ❖ Principals of Public Administration
- ❖ Research Methods
- ❖ Statistical Analysis
- ❖ Organizational Behavior
- ❖ Public Sector Microeconomics
- ❖ Public Financial Management
- ❖ Public Works Management I
- ❖ Public Works Management II
- ❖ Public Works and Urban Service Delivery
- ❖ Computer Applications in Public Works

University of California, Davis
(Certificate Program)

- ❖ Public Works Management I
- ❖ Public Sector Finance
- ❖ Public Capital Finance
- ❖ Budget Analysis
- ❖ Human Resource Management
- ❖ Communication in Public Management
- ❖ Dynamics of Leadership
- ❖ Public Works Management II

Texas A&M University
(PW Management Program)

- ❖ Environmental Law and Policy
- ❖ State and Local Financial Administration
- ❖ Theory and Practice of Public Administration
- ❖ Engineering Management Control Systems
- ❖ Special Topics in Infrastructure Management

University of Tennessee
(PW Program)

- ❖ Urban Drainage Engineering
- ❖ Solid Waste Management
- ❖ Traffic Engineering
- ❖ Construction Estimating
- ❖ Urban Systems: Engineering and Management

Public Works Institute, New Jersey
(Certificate Program)

- ❖ Management Tasks & Responsibilities Seminar
- ❖ Managing and Developing Human Resources
- ❖ Public Relations
- ❖ Operations Resource management
- ❖ Information Systems Workshop
- ❖ Municipal Planning and Urban Development
- ❖ State and Local Government Functions
- ❖ Budget Process for Public Works
- ❖ Purchasing Seminar

Illinois Institute of Technology
(Master of PW Degree)

- ❖ Economic Decision Analysis
- ❖ Systems Analysis
- ❖ Water & Waste Water Engineering
- ❖ Transportation Systems Management
- ❖ Introduction to Public Administration
- ❖ Public Works Management

University of Florida
(PW program)

- ❖ Public Works Planning
- ❖ Public Works Management

There appears to be much diversity from one program to the next. The main similarities these programs have in common are Public Works Management and Public Finance. Public Works Planning could arguably take third place among commonalities. Otherwise, each program is different, yet they are all intended for a similar purpose. Some of the programs emphasize management while others stress classic engineering and design, but they all intend to advance the profession of Public Works Management. Besides the core courses students are required to complete, they can choose from a specified list of optional courses that support the goals of the program.

University of Florida offers the most flexibility of those compared, requiring only two core courses. Although a certain amount of flexibility is needed to allow professionals to develop areas

of interest, and attract students who prefer the flexibility, there should also be a minimum required core (courses) that would most benefit the profession of Public Works Management. Correlating these programs with the results of a survey of senior professionals in the field of Public Works, that rate the value of courses, should provide a good base for a Public Works program.

Is there a combination of courses that will enhance success? Both the Profession and the University would benefit from such a program, as well as the student if the right combination were found. The APWA is conducting such a study and have already concluded that most of the keys to success have little to do with technical issues and are more focused on leadership, management, and administrative skills.[9]

The Education Foundation of the APWA in cooperation with the National Schools of Public Affairs and Administration and the American Society of Civil Engineers have developed curriculum guidelines to assure students completing these graduate programs achieve a standard set of skills. The skills that are required based on the input from the aforementioned groups are public management, planning, decision making, personnel management, finance, technology, and representation of public interest in quality of life.(10) Institutions that develop curriculum around these skills and ensure students achieve them, obtain official recognition from the APWA.

The Civil Engineer Corps of the U.S. Navy uses similar requirements to approve graduate programs. In order for a university to be approved for a particular area of study, certain educational skill requirements (ESR) must be able to be obtained by a student within a limited time frame, usually 12 months or less. To qualify for the Public Works option there are 12 ESRs that must be obtainable. These are as follows: (11)

1. Understand the principals of and be able to organize, plan direct, coordinate, and control activities in which people, money, and materials are efficiently and economically combined to provide effective engineering and facilities support services. Implicit is an understanding of the technical and managerial instruments available for proposing and implementing objectives, policies, and programs; policy analysis, program planning, and budgeting; accounting, evaluation, and control; and manpower planning.
2. Familiarity with solid waste management and water/ wastewater distribution, treatment, and disposal systems.
3. General knowledge of system analysis problems solving models, network analysis, benefit-cost analysis, and the role of systems analysis in public works decision making.
4. Working knowledge of utilities, including generation, distribution, and conservation techniques.
5. Understanding of labor relations and collective bargaining.
6. Understanding of the basic fundamentals of urban planning, effective land use development, and general real estate concepts.

7. Basic understanding of facility energy conservation techniques and environmental regulatory concepts.
8. At least one course which extends knowledge in any of the classical engineering disciplines. Courses can be in any technical area such as structural, pavement, environmental, geotechnical, hydraulics, hydrology, mechanical, or electrical.
9. Basic understanding of data processing and computer techniques for application to engineering problems.
10. Working knowledge of and ability to apply business and financial accounting principals.
11. Proficiency in oral and written communications and the ability to identify, research, and recommend alternatives to various engineering problems for presentation to both technical and non-technical managers.
12. If a thesis or major report is required for the degree, the topic selected must be applicable to public works engineering problems found in the Navy facilities business or extends the knowledge in a particular technical engineering area.

The Navy's ESRs encompass all of the skills required for official recognition by the APWA. A course does not need to be taken for each skill since several skills can be obtained from a single course. The requirement is that all of the skills must be obtained from the program of study to qualify for the subspecialty code of the Navy.

Perhaps the most complete and most specific proposed course content for a PWM program is provided by Willard Price, chapter 1, of Public Works Administration, Current Public Policy Perspectives, published by SAGE Publications Inc. The course content that is proposed, encompasses the entire practice of public works in the hopes of establishing a standard PWM program. The proposed course content follows:[12]

1. Public Infrastructure and the Society

- a. Public-Private roles in infrastructure development
- b. Infrastructure investment and the national economy
- c. Regional economic development and infrastructure systems

2. Public Works Institutions and Functions

- a. Local infrastructure systems and public works organization structures
- b. Regional agencies and special districts/governmental enterprises
- c. Federalism and public works - federal, state, and local roles

3. Infrastructure Development

- a. Strategic planning for infrastructure systems
- b. Capital planning and budgeting
- c. Financing innovation for infrastructure

4. Infrastructure Project Management

- a. Infrastructure project life-cycle
- b. Engineering/technology management
- c. Environmental planning and review

5. Public Works System Operations

- a. Public works service design and arrangements, including privatization
- b. Infrastructure information systems for planning, operations, performance, and productivity
- c. Public works customers, quality, and continuous improvement (Total Quality Management, Reengineering)

6. Public Works System Maintenance

- a. Managing maintenance strategies
- b. System reliability and failure response
- c. Safety and public risk management

7. Public Works Human Resources

- a. Public works management professionalism
- b. Public works personnel management, including employee training and development.
- c. Public works labor relations

8. Legal Issues Affecting Public Works Management

- a. Social equity/distribution of services
- b. Public works agency liability for system operation and failure
- c. Employee rights and diversity

A good Public Works program, geared towards the mid-level career professional, should have a solid core of required courses that meet most of these skills. Topics mentioned above as well as the skills required by APWA (and Navy ESRs) need to be obtainable by a package deal. Optional courses to tailor to the individual desires would complete such a program and ensure all of the required skills are met.

Part of the problem of obtaining an off the shelf program for the mid-level career Public Works professional is finding one that meets all of "required" skills. There is too much diversity in these programs, and it complicates the decision process for those professionals seeking the best path. Currently, it seems that each institution balances the required courses with APWA's recommendations (to obtain recognition) and their own philosophy of what is best for the public works manager and perhaps for the institution itself. There is simply too much variety in PWM programs, for what little there are to choose from.

If one succeeds in finding a program that meet all of the "requirements", but it isn't recognized, they would doubt the validity of the program. So, the other part of the problem is determining which PWM program is acceptable by society (society is meant to include all professional, academic, and governmental organizations involved public infrastructure) and best suited for career development. Universal recognition of specific skills for a PWM program by society is needed as part of the solution. A core curriculum that is universally recognized, aimed at career development for public works managers, should provide the impetus needed for PWM programs to be more successful.

Given that society needs to have technically proficient managers in charge of an aging and expanding base of infrastructure. And that there is a well-defined set of criteria of skills needed by these engineer-managers as presented by the APWA, Willard Price, and Navy ESRs. The question that comes to mind is "What would make a good core curriculum to a PWM program that would be sustainable?"

A survey of a random group of 50 senior Civil Engineer Corps Officers, currently working in the field of Public Works in the Navy, was taken to rank courses to form a basis for a PWM program of study. A response of 76% was obtained which equates to 38 out of 50 participants responding to the survey. The respondents averaged a total of 16 years of professional service. (Note: The question from which this information was taken from was pointed out as ambiguous by some of the respondents. As a result the average years of professional service reflect conflicting values between years that one has been registered as a professional and the number of years one has been professionally employed. Since the majority of those surveyed were Naval Captains and Commanders the average years of professional service, which was intended to represent the years one has been employed and working as a professional, rather than as a registered professional, appears to be lower than it should be.) The survey requested that the participants use their experience

and vision to assist in determining requirements for a Master of Public Works degree at the graduate level from a University that would benefit the U.S. Navy. Table 2 shows results of the survey:

TABLE 2

COURSE TITLE	PERCENT	MEAN
Facility Operations & Maintenance	97	1.03
Public Works Management	95	1.05
Public Works Planning	93	1.08
Government Budget & Finance	81	1.24
Legal Aspects of Civil Engineering	75	1.34
Principals of Management	70	1.42
Human Resource Management	68	1.47
Construction Cost & Econ Evaluation	67	1.50
Urban Environmental Engineering	64	1.55
Financial Accounting	60	1.66
Organizational Behavior	60	1.66
Urban Planning	58	1.74
Construction Planning/Scheduling	54	1.87
GIS Applications	53	1.89
Real Estate Management	52	1.92
Water Quality Management	50	2.00
Municipal Refuse Disposal	49	2.03
Construction Sustainability	48	2.08
Waste Water Engineering	47	2.13
Transportation Engineering	47	2.13
Negotiations	47	2.13
Public Relations	45	2.21

Each course was ranked by (1) - High Value; (2) - Valuable; (3) - Little Value. The percentage corresponds to the total number of respondents divided by the total points of the ranking. If every respondent ranked a particular course as a 1 then it would correspond to 100 percent. The score of 97 percent for the Facility Operations & Maintenance course was ranked as (1) by all of the

survey respondents except one, which ranked it as a (2). The total points it received was 39; thus $(38/39) * 100 = 97$.

The computed mean corresponds to the number of times each course was ranked by either (1), (2), or (3). For example the Government Budget and Finance course had 29 respondents ranking this as a (1), 9 respondents ranking this as a (2), and no respondents ranked this as a (3). Thus the mean was derived by the following computation;

$$[29 * (1) + 9 * (2) + 0 * (3)] / (29 + 9 + 0) = 1.24.$$

The survey forms are provided in Appendix (A) of this report.

The survey indicates that the courses which have the greatest benefit towards a Public Works program, intended for the Navy Civil Engineer Corps, are the ones with the lowest mean (closest to a value of 1). Facility Operations and Maintenance had the highest value to the Navy Civil Engineer Corps. (Most facilities are owned by the government on military installations and therefore facility management practices encompass the majority of the Navy's Public Works managerial duties.) As the mean increases the courses become of less value. Therefore, according to the survey, the courses listed with a lowest mean should be considered as high value.

Mr. Dennis Ross of the APWA selected a group of 25 Public Works professionals and distributed the exact same survey. The results were forwarded directly to me. Only 24% of the group responded to the survey. The average years of experience, as a

professional, is 24 years as compared to the 16 years reported by the Civil Engineer Corps survey. (Again note there could be errors to the number of years of "professional" service depending on whether the respondent interpreted this to mean "as a registered professional" or "professionally employed in a public works environment".) The survey forms for the APWA group are provided in Appendix B of this report.

The results were computed exactly in the same manner as described previously for the Navy survey. Table 3 is a summary of the result for the APWA survey.

TABLE 3

COURSE TITLE	PERCENT	MEAN
Public Works Management	100	1.00
Public Works Planning	100	1.00
Construction Planning/Scheduling	100	1.00
Government Budget & Finance	86	1.17
Legal Aspects of Civil Engineering	86	1.17
Facility Operations & Maintenance	75	1.33
Waste Water Engineering	75	1.33
Transportation Engineering	75	1.33
Water Quality Management	75	1.33
Principals of Management	75	1.33
GIS Applications	75	1.33
Public Relations	67	1.50
Municipal Refuse Disposal	67	1.50
Urban Environmental Engineering	67	1.50
Construction Cost & Econ Evaluation	67	1.50
Human Resource Management	55	1.83
Urban Planning	50	2.00
Organizational Behavior	50	2.00
Negotiation Course	46	2.17
Construction Sustainability	46	2.17
Financial Accounting	43	2.33
Real Estate Management	38	2.67

Both surveys assume that the participants are familiar with the general content of each course. Courses, which stress concepts normally considered outside of the Civil Engineering area, were emphasized by denoting the school to which they would normally be taught. For example Urban Planning is listed as Architectural (ARCH) on the survey form. Since the participants of the survey have a high experience level and most if not all have attended post graduate school, the course content should be considered traditional in concept.

Both surveys and required skills mentioned in the previous chapter are used to form the basis of recommendations for a core set of courses, which would be required for a PWM program of study. The comparison is primarily based on the computed mean value of each course. The courses that offer the greatest benefit, or highest value, between the two survey groups should provide a good base, or foundation, to a Public Works program.

Generally there are 32 credits required for graduate degrees in similar Public Works programs. Since each course listed in the survey is normally a 3 credit course, the top 10 courses would comprise of 30 credits, which would make up a typical graduate program, except for the thesis or masters report. The number of required courses to consist of a required curriculum is subject the amount of flexibility an institution will allow. Too many required courses could result in limiting enrollment, on the other hand a good foundation recognized by APWA and senior officials in Public Works could attract candidates seeking to advance their careers. Therefore a straightforward approach is proposed that requires 50 percent, or 5 out of 10 courses, that are considered of high value to both, the Navy CEC and their civilian counterparts in the profession.

There are 6 courses in the top 10 of each survey that matched. These courses are shown in table 4 below:

TABLE 4

COURSE TITLE	CEC	CIV	AVE
Public Works Management	1.05	1.00	1.03
Public Works Planning	1.08	1.00	1.04
Facility Operations and Management	1.03	1.33	1.18
Government Budget and Finance	1.24	1.17	1.21
Legal Aspects of Civil Engineering	1.34	1.17	1.26
Principals of Management	1.42	1.33	1.38

The courses in table 4 are listed in order of their average computed mean. Since all of these courses are listed in the top 10 of each survey, and therefore of high value to both Navy CEC and civilian professionals, they should all be considered for the core curriculum of a PWM program. However to allow for flexibility in the program there should be a limit to the number of required courses.

The top 5 courses are recommended for the required core of the program. Granted this may appear to be biased towards the Navy by simply averaging the survey results and claiming an equal weight to that of society but the results seem justifiable. It could be argued, based on the numbers, that rather than requiring Facility Operations & Maintenance as a standard course Waste Water, Water Quality, Transportation, or GIS Applications could easily take its

place. However the course content of Facility Operations & Maintenance provides management principles rather than technical discipline and therefore better suited to the goals of a PWM program. The top 5 courses comprise of leadership and management courses and are consistent with the APWA conclusion stated previously, that the keys to success are focused on leadership, management, and administration skills.

The content of these courses can be manipulated to meet most of the skills desired by the APWA, Willard Price, and the Navy ESRs. A proposed course outline for each of the required courses is provided in appendix C of this report. The course outlines proposed are provided as a starting point and should be further developed to ensure they meet all of the desired skills.

The optional courses that would make up the remaining part of the program should consist of courses related to the public works environment or further business skills. All of the courses listed on the survey and listed by tables 3 and 4, are considered to be of some value to the Public Works Manager and are proposed to be the standard optional courses. Approval by the advisor of the program should be obtained for courses not listed as optional.

Courses outside the control of the department administering the Public Works program should be encouraged and coordinated by the advisor of the program. These types of courses often add greater insight to the Public Works Manager. Since a manager often deals with problems outside of the department and must interact with

other professionals, learning and interacting with students from other departments on campus can be very beneficial. The wider one's perspective is, the better they are to understand and organize abstract concepts. It is also more efficient for the institution to have a single department focus on a course rather than to have duplication of efforts across the campus. For example, a "Planning" course should be taught by the Urban Planning department, and the School of Business should teach a "Management" course.

Although it was not listed by the survey or previously recommended, a Graduate Seminar is also a very important part of the program. A seminar can reinforce important concepts of business, leadership, or technical skills that are either missing from a program or in need of further strengthening. For example, Public Relations isn't normally a part of a Public Works program, and the survey results from the CEC indicate it is the least important course with a mean score of 2.21 (the APWA survey reported it as a 1.50 mean score, or 12/22). A seminar can introduce public relation strategies and involve the students in case studies that require public relations solutions. A proposed syllabus for a Graduate Seminar is provided by Appendix D of this report. The syllabus for the seminar is based on the recommendations of this report and written notes from both surveys. It may prove beneficial to offer such a seminar in the evenings to attract local professionals and public officials interested in these subjects.

There needs to be a consistency in PWM program that offers a solid foundation of skills that are basic to advancing professional engineers into management of public infrastructure. These skills are probably best summarized by Willard Price's 8 topics mentioned previously. These topics should be covered by a required curriculum that is standard among schools of higher learning for graduate programs. Based on the recommendations of the previous chapter the PWM curriculum should be as follows in Table 5:

TABLE 5

<u>Required Core Courses</u>	<u>Credit</u>
Public Works Management	3
Public Works Planning	3
Facility Operations and Management	3
Government Budget and Finance	3
Legal Aspects of Civil Engineering	3
Total Required Core	15
<u>Optional Courses</u>	
Real Estate Management	3
Urban Planning	3
Municipal Refuse Disposal	3
Public Relations	3
Waste Water Engineering	3
GIS Applications	3
Financial Accounting	3
Human Resource Management	3
Transportation Engineering	3
Urban Environmental Engineering	3
Construction Cost & Economic Eval	3
Construction Planning and Scheduling	3
Water Quality management	3
Business Negotiations	3
Principles of Management	3
Organization Behavior	3
Principles of Sustainability	3
Graduate Seminar	1
Total Required Credits for Degree	32
Masters Report/Thesis	2/6

The program content needs to be universally recognized and established. Once established, the agreed upon curriculum will become more recognizable, and perhaps more sought after. After all, once a path is beaten down, many will follow.

There is also a need for advisors or program administrators to keep PWM programs active. This lack of faculty is evident in the lack of PWM programs available. Courses need to be taught and professional texts need to be written. Too often these programs are becoming defunct due to the retirement of academic staff. The role of the program advisor is essential to keeping a path accessible so students have a direction in which to travel.

Wider interest in advanced education for management also needs developed in the Public Works profession. PWM programs become inactive without sufficient numbers of students engaged in higher learning. Where there is a lack of management skills in Public Works (especially in larger cities), it will be filled by others who lack engineering skills, but have the business skills that are required to running a large program. City managers prefer to appoint professional engineers as Directors of Public Works but will fill these positions with non-engineers to obtain the leadership and administration skills they believe is necessary to manage the department.[13]

Engineers that are interested in developing management skills within the profession of public works need information on the availability of these programs. There are currently very few programs that offer management related to the public works discipline. Perhaps the technical professionals choosing to advance into management look to Business or Public Administration programs since these are much more established. Most Navy CEC officers don't have information on PWM programs and how they measure up to the Navy's ESRs. To increase awareness and promote wider interest for a PWM program information needs to be disseminated. Appendix E provides a proposed brochure that can be used to promote the curriculum proposed in this report.

In summary, PWM programs should be more consistent and universally recognized. This should lead to more stability of these programs and attract advisors as well as students interested in public works management. There also needs to be wider dissemination of information on these programs to those that could benefit from the advanced education. Ultimately, a universally recognized standard curriculum should benefit society as a whole, by having suitable managers in charge of an increasingly complex infrastructure that supports our civilization.

Notes

(1) - Public Works Administration, Current Public Policy Perspectives, Lucy Brewer - Editor, SAGE Publications Inc 1997, pp. 9. Willard Price defines the academic field of Public Works Management in the first chapter of this book.

(2) - State of the Civil Engineer Corps, Fiscal Year 1998, Navy Bureau of Personnel Code 4413, pp. 55.

(3) - State of the Civil Engineer Corps, Fiscal Year 1998, Navy Bureau of Personnel Code 4413, pp. 53.

(4) - Dr. Graham A. Bullen, Associate Professor, Civil & Environmental Engineering, University of Pittsburgh, E-Mail Bullen/Ellwood dated 05 April 1999.

(5) - Mr. Dennis Ross, American Public Works Association, Director of Professional Development, E-Mail Ross/Ellwood dated 13 Apr 99.

(6) - Graduate Study in Public Works, American Public Works Association Education Foundation, Brochure dated 1980. Mr. Dennis Ross, APWA, confirmed current status of various programs by voice communication dated 11 May 1999.

(7) - Public Works Administration, Current Public Policy Perspectives, Lucy Brewer - Editor, SAGE Publications Inc 1997, pp. 16. Willard Price discusses history of the Public Works Management program.

(8) - Information obtained from brochures from each university or institution. Telephone calls confirmed some of this information and the APWA provided other information to support status of the programs.

(9) - Mr. Dennis Ross, American Public Works Association, Director of Professional Development, E-Mail Ross/Ellwood dated 13 Apr 99.

End Notes (Cont.)

(10) - Graduate Study in Public Works, American Public Works Association Education Foundation, Brochure dated 1980. Mr. Dennis Ross, APWA, confirmed current status of various programs by voice communication dated 11 May 1999.

(11) - United States Navy Graduate Education Handbook, Internet address: <http://www.navy.mil/codes/pers4/pers/44/pers4413/2gradedu.htm>

(12) - Public Works Administration, Current Public Policy Perspectives, Lucy Brewer - Editor, SAGE Publications Inc 1997, pp. 11. Willard Price comments on the frustration that arises in the public works field due to diversity in both practice and academic discipline. His academic content is proposed to bring order from the existing chaos of this field.

(13) - Public Works Administration, Current Public Policy Perspectives, Lucy Brewer - Editor, SAGE Publications Inc 1997, pp. 35. Karl F. Johnson, in chapter 2 discusses differences between Public Works Directors and Chief Executive Officers.

End Quote:

The older I get, the less attention I pay to what people say or think or hope. I notice what they do, how they live, and what they work for.

There is an unresolved argument in the arts and in politics over whether one's words are to be judged with regard to one's life. I come down on the side of integrity: The life validates or invalidates the words.

Oratory is empty if it has not been field-tested on the battlefield of experience. And I have little use for those who write beautifully and live sordidly; or those who withdraw from the world and issue instructions for how to live in it; or priesthood that deny the realities of the flesh but wish to control the appetites and activities of those who live as whole human beings. If you don't play the game, you can't know enough to make the rules. If you are not engaged in the sweaty work of the world, you should not be in charge of the deodorant concession. And if you cannot find a way to progress in human affairs, then know that the smirking cynicism of the sideline critic is a form of a plague - and to be one of those is to be a carrier of death instead of a preserver of life.

Strong words? Yes, and deeply felt.

The closest I ever come to angry violence is in the presence of someone who says he will not even bother to vote because it doesn't make a difference. I saw a bumper sticker on the back of an old Buick: "If voting really changed anything it would be illegal". I felt like giving the driver a bumper bang from behind.

He's typical of those who have a shallow view of history - those who don't understand that nobody has a right to ride on the bus without making some contribution to the cost of the journey. They don't respect the fact that somebody else paid the price to build the vehicle of civilization in the first place. They owe. We owe. It's moral obligation to participate in the work of society. If you take from the pot, you must put into the pot. Even those who have no money can sing and keep the driver of the bus awake and hopeful.

It has been said that the hottest places in Hell are reserved for those who, in times of moral crisis, maintain their neutrality. And I say the moral crisis of the times is continuous. Knowing and understanding and being are not enough. One must do. To gain the world and give nothing to it is to lose your soul.

In the words of Norman Cousins, "The tragedy of life is not death, but what we let die inside us while we live."

- Robert Fulghum, Words I Wish I Wrote,
Harper Collins Publisher, pp 76

APPENDIX A - CEC SURVEY

Survey forms not provided. Original document at University of Florida has the original survey forms, pages 32 - 107.

APPENDIX B - APWA SURVEY

Survey forms not provided. Original document at University of Florida has the original survey forms, pages 108 - 113.

APPENDIX C:

COURSE OUTLINES

Public Works Management

Public Works is a wide and diverse field in discipline and practice. Multiple functions of water resources, wastes, transportation, facilities, and other public facilities are combined to ensure public safety, health, and convenience, as well as the stimulation of economic development and sustainable growth to enhance the standard of living and quality of life to a community. Management of these systems is becoming more and more complex. This course should engage students in the relationships of the design/planning, finance, maintenance, privatization of infrastructure.

Part I - Background History and Organization

Integrity and Ethics

Public Works Manager

Organization, Structure, and Relationships

Part II - Quality Management

Classifications and Job Analysis

Performance Appraisals and Counseling

Motivation and Incentives

Labor Relations

Changing the Climate, Culture, and Values of a Department

Enhancement of Operational Efficiencies

Assessing Customer Preferences

Analyzing Policy for Planning and Development

Privatization

Part III - Facilitating Change

The Living Infrastructure

Unforeseen Problems in Public Projects

New Mexico's Colonias

Civil War on Waste

Part IV - Studies in Policy Complexities

Public Works Services

Airport Privatization

Environmental and Social Effects of Highways

In Defense of NIMBYs

Text - *Public Works Administration*, Lucy Brewer, editor,
SAGE Publications, 1997

Text - *Management of Local Public Works*, ICMA 1986

Public Works Planning

Planning is the practice and art of detailing an idea from concept to implementation. Planning is vital to a successful organization or a community. As resources become more and more limited, planning becomes essential for sustainability.

The following course outline provides an overview of important topics and concepts of planning.

PART I - Planning in the Government

Local Planning
County Planning
State Planning
Federal Planning

PART II - Planned Development

Comprehensive Plans
System / Subsystem Plans
Area Plans
Site Plans
Zoning

PART III - Planning for Tomorrow

Best Development Practices
Deep Design Principles
Sustainability in Relation to Planning
Landscape Planning

Note: Texts Books need to be reviewed to meet the complexities of planning for infrastructure development.

Texts for Part III -

Best Development Practices, Reid Ewing, Florida State 1996

Deep Design, David Wann, Island Press 1996

Our Ecological Footprint, Wackernagel & Rees, NSP 1996

Placing Nature, Joan Nassauer, Island Press 1997

Facility Operations and Management

Facility Operations and Management is becoming more of a specialized professional career as time goes by. Every business or industry, including local, state, and federal governments require facilities to be managed. This course should be designed to provide a working knowledge of the expertise necessary to function on different levels of corporate and public facilities.

Part I - Background and Organization

Nature of Facility management

Organization

Facility Management Leadership

Part II - Planning programming, and Budgeting

Strategic and Annual Planning

Financial Management

Space Planning and Management

Part III - Real Estate

Real Estate Options

Lease Administration

Property management

Part IV - Design-Build Cycle

Project Management

Programming and Project Development

The Design Process

The Construction Phase

Part V - Operations and Maintenance

Work Coordination

Facility Operations

Maintenance and Repair

Facility Services

Part VI - Facility Management Practice

Administering the Department

Managing Quality in Facilities

Managing the Budget

Information Systems and Other Technology

The Class should use a series of field trips to various Facility Management organizations to expose students to the breadth of the kind of work of which is required.

Text - *The Facility Management Handbook Second Edition*,
David G. Cotts, American Management Association 1999

Government Budget and Finance

The further a manager progresses in leadership and executive capacity the greater the need to understand where and how expenditures are handled. Since many Civil Engineers work for the city, state, or federal government, a student should be able to understand how and under what constraints each system operates. More and more budgets operate under complex rules and procedures that directly affect communities and business.

PART I - Budgets

Politics of Budgeting for Local, State, and Federal Agencies
Budgeting Process, Purpose, and Types
Managing the Budget

PART II - Revenues

Revenue Legislation
Taxes (Property, Consumption, Income, Permits, User
Charges, Intergovernmental, and Nontax revenue)
Trust Funds
Bonds
Government Debt

PART III - Finance

Financial Management Roles by Entity
Appropriations
Program Finance
Project Finance
Accounting
Life-Cycle Costing
Financial Analysis

This course should examine the economics and politics of public finance at all levels in the government. Theory of market failure, types and principals of taxation, government borrowing and debt management, user fees, and economic development relation to infrastructure should be of focus.

Legal Aspects of Civil Engineering

The further a professional progresses in leadership and executive capacity the greater the need to understand various legal principals. This course is intended for practicing engineers, architects, and contractors. Case studies of actual problems should be used to develop the student appreciation of the depth of this subject.

PART I - Basic Principals of Laws

Definitions

Constitutional Principles of Separation of Power

Formation Principals

Interpretation and Construction

Performance or Breach of Contract Obligations

PART II - Application of Law to Construction Contracts

Contacts

Drawings

Specifications

Contract Modifications

Proposals

Equitable Adjustments

PART III - Other Legal Matters Relating to Engineers

Corporations and Partnerships

Torts

Real Property

Labor Law

Environmental Law

Professional Liability

Ethics

Course should be intertwined with actual case studies and student presentations. Expert guest lecturers can also emphasize and reinforce concepts.

Text - *Common Sense Construction Law*, Smith, Currie & Hancock, published by John Wiley and Sons, New York, NY, 1997

- *Contracts, Specifications, and Law for Engineers*, Dunham, Young, and Brockrath, McGraw-Hill Inc, 1979

APPENDIX D:

GRADUATE SEMINAR

The Graduate Seminar is provided to introduce key concepts and current information to Public Works professionals interested in advancing their careers in management and executive capacities. Topics will vary depending on the availability of speakers. Each topic should promote books/literature on subject as well as provide additional sources of information that can be obtained.

Waste Water Treatment Systems
Business Review of Finance/Statistics for Managers
Transportation Systems
Information Technology
GIS Applications to Public Works
Positive Public Relations
Environmental Law
City Planning Issues
Solid Waste Disposal
Sustainability
Total Quality Leadership/Management
Emergency Operation Management (FEMA)
Outsourcing/Privatization in Public Works
Water Management
Politics in Public Works
Executive Writing Workshop
Computerized Applications for Risk Management
Benchmarking Facilities
Reliability-Centered Maintenance
Landscaping as an Investment
EPA's Energy Star Building Program
Leadership/Management Workshop
Innovative Public Works Practices
Energy Management

UNIVERSITY OF FLORIDA

Infrastructure Management



REQUIRED CORE COURSES	CREDITS
Public Works Management (Fall term)	3
Public Works Planning (Spring term)	3
Facility Operations & Management (Spring term)	3
Legal Aspects of Civil Engineering (Fall term)	3

Degree Requirements. The professional Public Works curriculum requires a total of 32 credits, 12 required core course credits and 18 optional course credits, as well as a thesis or Masters Report.

OPTIONAL COURSES

Financial Management
Principals of Management
Human Resource Management
Construction Cost & Economic Evaluation
Urban Environmental Engineering
Organizational Behavior
Urban Planning
Construction Planning & Scheduling
GIS Applications
Real Estate Management
Municipal Refuse Disposal
Water Quality Management
Public Relations
Waste Water Engineering
Transportation Engineering
Business Negotiations
Principals of Sustainability

University of Florida
Department of Civil Engineering
Gainesville, Florida
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PUBLIC WORKS ENGINEERING MANAGEMENT

1. As the foundation of civilization is supported by its infrastructure, the foundation of a profession is supported by education. It is imperative for a society interested in advancing civilization to advance standards of education for its professionals responsible for the infrastructure.

2. The American Public Works Association has officially recognized the University of Florida for its Public Works Graduate Program.

3. The program of study, for Public Works Management, may be carried in Civil Engineering or in Environmental Engineering Departments at the University of Florida.

4. The Public Works Management program at the University of Florida will also satisfy the U.S. Navy Civil Engineer Corps educational skill requirements.

MASTER OF ENGINEERING

Students pursuing the Public Works Management program can obtain a Master of Engineering Degree upon completion of all requirements.

ADVANCE YOUR CAREER

Executives and Managers of public infrastructure should have a solid background in Public Works Systems. Larger cities often hire professionals who have business and management skills with little or no engineering background because professional engineers generally do not obtain formal educational training in management. The program at University of Florida is aimed at the professionals who have 5 - 10 years of experience and want to advance in executive capacities.

Chance favors only the mind that is prepared.
- Louis Pasteur

WHO BENEFITS FROM A PUBLIC WORKS PROGRAM

Actually a wide variety of people can benefit from such a program. People, who are within the sphere of public policy and concerned with the direction of public administration and practices of community organizations, as well as those who propose policy, should benefit. Military engineers, consulting firm employees, public administrators, and citizens wishing to pursue a greater understanding of government and factors involved in public works issues will benefit from such a program. However, as this program gains in interest, it is ultimately society that will benefit.

POINTS OF CONTACT

Those interested in obtaining more information about the University of Florida graduate program for Public Works Management can contact the following persons:

Dr. Paul Y. Thompson, P.E.
Chairman

Department of Civil & Coastal
Engineering
352-392-9537

Dr. Fazil T. Najafi, P.E.
Associate Professor
Public Works Program Coordinator
Department of Civil Engineering
352-392-1033

Martha Nell Hinkle
Program Assistant
Department of Civil & Coastal
Engineering
352-392-0933

VISIT THE WEB SITE

www.ufl.edu

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Government Document

Emergency Operations Plan. Alachua County Office of Emergency Management. Gainesville, FL.: 1999.

Brochure

Graduate Study in Public Works. American Public Works Association, Education Foundation. 1980.

Brochure (Con't)

California State University. Public Administration Program.
Cleveland State University. Public Works Management Program.
Cornell University. Engineering Management Program.
Illinois Institute of Technology. Public Administration Program.
Northeastern University. Public Works Management Program.
Texas A&M University. Public Works Management Program.
University of Florida. Public Works Management Program.
University of Missouri-Kansas. Public Administration Program.
University of New Jersey, Rutgers. Public Works Management.
University of Pittsburgh. Public Works Program.
University of Tennessee. Public Works management program.

Electronic Mail

From: Dr. Grahm A. Bullen, Associate Professor, University of Pittsburgh.
To: John M. Ellwood, Graduate Student, University of Florida.
Dated: 05 April 1999.

From: Mr. Dennis Ross, American Public Works Association.
To: John M. Ellwood, Graduate Student, University of Florida.
Dated 13 April 1999.

Voice Communication

Telephone interview with Mr. Dennis Ross, by John M. Ellwood.
Dated 11 May 1999.

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